What is Claimed:

1. An apparatus for cutting an indefinite length of suture to uniform lengths for subsequent threading and swaging to surgical needles having a suture receiving opening formed therein, comprising:

(a) a drawing frame, having at least one longitudinal member and defining a drawing axis parallel thereto;

(b) tipping means for heating a predetermined small length of the suture to stiffen the small length of suture after subsequent cooling thereof, in preparation for cutting the suture at the stiffened small length and inserting a stiffened lead cut end of the suture into an end of a needle for swaging thereto;

(c) first and second gripping means for gripping said indefinite length suture and alternately drawing it along said drawing axis, said first and second gripping means being mounted for reciprocal movement on said at least one longitudinal member, wherein one of said first and second gripping means draws the indefinite length suture to a position beyond said cutting means, while the other of said first and second gripping means reciprocates to a start position along said drawing axis before said cutting means, such that the first and second gripping means are used alternately to draw suture through the apparatus and feed the suture into a needle;

(d) means for cutting said indefinite length suture to provide uniform lengths of suture;

(e) means for providing a predetermined long length of suture travel between the tipping means and the cutter means, wherein said predetermined long length of suture travel is a discrete number, two or more, times the uniform length of suture being cut by the apparatus, to provide a discrete number, two or more, of apparatus cutting cycles between tipping of the suture at the tipping means and cutting of the suture at the cutting means, whereby after heating of a small length of suture at the tipping means, the suture is cooled to allow setting and hardening of the suture material prior to cutting.

2. An apparatus as claimed in claim 1, wherein said discrete number comprises at least three.

3. An apparatus as claimed in claim 2, including at least one small diameter idler roller for guiding the suture to the tipping means, and after heating thereat, the suture is drawn to and rotates around a large diameter idler roller, large relative to the diameter of the small diameter idler roller, which is provided because the small length of suture which has been heated at the tipping means has begun to harden and set by the time the heated suture reaches the large diameter idler roller, and the large diameter thereof facilitates the suture to travel therearound and change direction, without picking up a permanent curve set from the large idler roller, to provide a straight suture, without any curve, when it is subsequently cut and inserted into a needle.

4. An apparatus as claimed in claim 3, wherein the tipping means is positioned near the top of the

apparatus, and the large diameter idler roller is positioned near the bottom of the apparatus, and the suture reverses direction at the large diameter roller and is drawn vertically upwardly to the first and second gripping means and the cutter means.

5. An apparatus as claimed in claim 4, wherein the large diameter idler roller has a diameter larger than 6 inches.

6. An apparatus as claimed in claim 5, wherein the large diameter idler roller has a diameter of substantially 7 inches.

7. An apparatus as claimed in claim 1, including at least one small diameter idler roller for guiding the suture to the tipping means, and after heating thereat, the suture is drawn to and rotates around a large diameter idler roller, large relative to the diameter of the small diameter idler roller, which is provided because the small length of suture which has been heated at the tipping means has begun to harden and set by the time the heated suture reaches the large diameter idler roller, and the large diameter thereof facilitates the suture to travel therearound and change direction without picking up a permanent curve set from the large idler roller, to provide a straight suture, without any curve, when it is subsequently cut and inserted into a needle.

8. An apparatus as claimed in claim 7, wherein the tipping means is positioned near the top of the apparatus, and the large diameter idler roller is positioned near the bottom of the apparatus, and the suture reverses direction at the large diameter roller

and is drawn vertically upwardly to the first and second gripping means and the cutter means.

9. An apparatus as claimed in claim 7, wherein the large idler roller has a diameter larger than 6 inches.

10. An apparatus as claimed in claim 1, wherein the position of the cutting means along the drawing axis is continuously adjustable to provide an infinite number of possible different lengths of cut suture;

11. An apparatus as claimed in claim 10, wherein for each different position of the cutting means, the tipping means is adjustably positioned at a different predetermined position in the apparatus to provide for the tipped section of suture to be precisely positioned at the cutter means after said discrete number of apparatus cycles.

12. An apparatus as claimed in claim 11, wherein the tipping means includes a pointer positioned adjacent to a linear measurement scale stationarily positioned in the apparatus, such that the position of the tipping means is precisely controlled by aligning the pointer with a specified reading on the linear measurement scale.

13. An apparatus as claimed in claim 12, wherein the position of the tipping means in the apparatus is adjustable by a handcrank and precision leadscrew, such that as the handcrank is rotated, the position of the tipping means in the machine is changed.

14. An apparatus as claimed in claim 10, wherein the tipping means includes a pointer positioned adjacent to a linear measurement scale stationarily positioned in

the apparatus, such that the position of the tipping means is precisely controlled by aligning the pointer with a specified reading on the linear measurement scale.

15. An apparatus as claimed in claim 10, wherein the position of the tipping means in the apparatus is adjustable by a handcrank and precision leadscrew, such that as the handcrank is rotated, the position of the tipping means in the machine is changed.

16. An apparatus as claimed in claim 1, wherein the suture extends to and is wrapped around a tension roller which is mounted on one end of a torque motor, which applies a given tension to the suture as it is pulled through the apparatus by the first and second gripping means.

17. An apparatus as claimed in claim 16, wherein the suture is wrapped around the tension roller a multiple number of times.

18. An apparatus as claimed in claim 17, wherein the suture is wrapped around the tension roller twice.

19. An apparatus as claimed in claim 16, wherein each of the first and second gripping means includes a releasable suture clamp positioned thereon which releasably clamps the suture during an initial auto threading of a new lead of suture through the apparatus.

20. An apparatus as claimed in claim 1, wherein each of the first and second gripping means includes a releasable suture clamp positioned thereon which releasably clamps the suture during an initial auto threading of a new lead of suture through the apparatus.

Sub B1 21. A method for cutting an indefinite length of

suture to uniform lengths for subsequent threading and swaging to surgical needles having a suture receiving opening formed therein, comprising:

Sub B1

(a) feeding the indefinite length suture to a drawing axis of apparatus for drawing and cutting thereof, said drawing axis being defined as being parallel to first and second longitudinal members of a drawing frame;

(b) heating a predetermined small length of the suture to stiffen the small length of suture after subsequent cooling thereof, in preparation for cutting the suture at the stiffened small length and inserting a stiffened lead cut end of the suture into an end of a needle for swaging thereto;

(c) gripping said indefinite length suture and alternately drawing it along said drawing axis by first and second gripping means, said first and second gripping means being mounted for reciprocal movement on said at least one longitudinal member, wherein one of said first and second gripping means draws the indefinite length suture to a position beyond said cutting means, while the other of said first and second gripping means reciprocates to a start position along said drawing axis before said cutting means, such that the first and second gripping means are used alternately to draw suture through the apparatus and feed the suture into a needle;

(d) cutting said indefinite length suture to provide uniform lengths of suture;

(e) providing a predetermined long length of suture travel between the tipping step and the cutter

step, which is a discrete number, two or more, times the uniform length of suture being cut by the apparatus, to provide a discrete number, two or more, of apparatus cutting cycles between tipping of the suture and cutting of the suture, whereby after heating of a small length of suture, the suture is cooled to allow setting and hardening of the suture material prior to cutting.

22. A method as claimed in claim 21, wherein said discrete number comprises at least three.

23. A method as claimed in claim 22, including guiding the suture to the tipping step by at least one small diameter idler roller, and after heating thereat, drawing the suture around a large diameter idler roller, large relative to the diameter of the small diameter idler roller, which is provided because the small length of suture which has been heated at the tipping means has begun to harden and set by the time the heated suture reaches the large diameter idler roller, and the large diameter thereof facilitates the suture to travel therearound and change direction without picking up a permanent curve set from the large idler roller, to provide a straight suture, without any curve, when it is subsequently cut and inserted into a needle.

24. A method as claimed in claim 23, including tipping the suture near the top of the apparatus, and positioning the large diameter idler roller near the bottom of the apparatus, such that the suture reverses direction at the large diameter roller and is drawn vertically upwardly to the first and second gripping means.

5 ~~25~~. A method as claimed in claim 4 ~~24~~, including providing the large idler roller with a diameter larger than 6 inches.

26. A method as claimed in claim 21, including guiding the suture to the tipping step by at least one small diameter idler roller, and after heating thereat, drawing the suture around a large diameter idler roller, large relative to the diameter of the small diameter idler roller, which is provided because the small length of suture which has been heated at the tipping means has begun to harden and set by the time the heated suture reaches the large diameter idler roller, and the large diameter thereof facilitates the suture to travel therearound and change direction without picking up a permanent curve set from the large idler roller, to provide a straight suture, without any curve, when it is subsequently cut and inserted into a needle.

Sub B3 27. A method as claimed in claim 26, including tipping the suture near the top of the apparatus, and positioning the large diameter idler roller near the bottom of the apparatus, such that the suture reverses direction at the large diameter roller and is drawn vertically upwardly to the first and second gripping means.

5 6 ~~28~~. A method as claimed in claim ~~26~~, including providing the large diameter idler roller with a diameter larger than 6 inches.

9 8 ~~29~~. A method as claimed in claim ~~28~~, including providing the large diameter idler roller with a diameter of substantially 7 inches.

30. A method as claimed in claim 21, including performing the cutting at any position along the drawing axis to provide an infinite number of possible different lengths of cut suture.

31. A method as claimed in claim 30, wherein for each different position of the cutting step, the tipping is performed at a different predetermined position to precisely position the tipped section of suture at the cutter means after said discrete number of apparatus cycles.

32. A method as claimed in claim 31, including positioning the tipping step by positioning a pointer adjacent to a specified reading on a linear measurement scale stationarily positioned in the apparatus.

33. A method as claimed in claim 32, including positioning the tipping step in the apparatus by rotating a handcrank and precision leadscrew.

34. A method as claimed in claim 30, including positioning the tipping step by positioning a pointer adjacent to a specified reading in a linear measurement scale stationarily positioned in the apparatus.

35. A method as claimed in claim 30, including positioning the tipping step in the apparatus by rotating a handcrank and precision leadscrew.

36. A method as claimed in claim 21, including applying a given tension to the suture as it is pulled through the apparatus by the first and second gripping means by wrapping the suture around a tension roller which is mounted on one end of a torque motor.

17 16
~~37~~. A method as claimed in claim ~~36~~, including wrapping the suture around the tension roller a multiple number of times.

19 17
~~38~~. A method as claimed in claim ~~37~~, including wrapping the suture around the tension roller twice.

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39. A method as claimed in claim 21, including positioning a releasable suture clamp on each of the first and second gripping means, and clamping the suture with a releasable suture clamp during an initial auto threading of a new lead of suture through the apparatus.